612.36255X00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s):	Marc FLEURY et al
Serial No.:	09/083,180
Filed:	May 22, 1998
For:	IMPROVED DEVICE FOR MEASURING PHYSICAL CHARACTERISTICS OF A POROUS SAMPLE
Art Unit:	2856
Examiner:	Mark A. SHABMAN Conf. No.: 3669

AMENDMENT

MS: Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

June 10, 2011

Sir:

This is in response to the first Office Action, dated March 14, 2011. Please amend the above-identified application as listed below and as set forth on the following pages:

Amendments to the Specification and Abstract

Amendments to the Claims

Amendments to the Drawings describing changes to drawings shown in the Appendix

Remarks are included following the amendments

An Appendix including amended drawing figures is attached following the Remarks.

AMENDMENTS TO THE SPECIFICATION:

A Substitute Specification is submitted herewith. A marked-up copy of the original specification containing the amendments in the specification and the amendments to the claims is submitted herewith. It is submitted that the Substitute Specification does not introduce new matter.

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1-8. (Cancelled)

9. (New) An improved device for measuring physical characteristics of a porous solid sample by performing successive drainage and imbibition phases, in the presence of a first electrically-conducting fluid and of a second fluid of lower density than the first fluid comprising:

rotatable mobile equipment including at least one elongate vessel provided with an inner cavity for the sample, the at least one vessel being fastened to an end of an arm secured to a fulcrum pin and associated with means for balancing, means for driving the arm in rotation for creating a centrifugal force exerted along a direction of elongation of the at least one vessel, a system for displacing at least the second fluid of lower density, and means for detecting an interface position of the fluids in the at least one vessel comprises a capacitive sonde placed in the at least one vessel along a direction of elongation thereof, for continuously detecting displacement of the interface between the two fluids in the at least one vessel, and the means for detecting an interface position of the fluids in the at least one vessel being externally connected to a measuring device through a rotatable connector.

10. (New) A device as claimed in claim 9, wherein the capacitive sonde comprises a metallic rod coated with a layer of a dielectric material and connected to means for measuring the capacitance variation of the sonde in contact with the fluids in the at least one vessel resulting from the immersion thereof in the conducting fluid.

11. (New) A device as claimed in claim 9, comprising a system for controlling at least transfer of one of the fluids in the at least one vessel to maintain the interface between the two fluids at a determined level in the at least one vessel .

12. (New) A device as claimed in claim 10, comprising a system for controlling transfer of at least one of the fluids in the at least one vessel to maintain the interface between the two fluids at a determined level in the at least one vessel .

13. (New) A device as claimed in claim 9, wherein the system is stationary and is connected to the at least one vessel by the rotatable connector including a sealed rotating electro-hydraulic connector, hydraulic lines and an electrical link and includes a pump for the fluid having the lower density, a tank for collecting at least part of the fluid expelled from the sample and a programmed micro-computer for acquiring signals from a means for measuring and controlling transfer of the fluids, to maintain the interface between the two fluids at a constant level during operation.

14. (New) A device as claimed in claim 10, wherein the system is stationary and is connected to the at least one vessel by the rotatable connector including a sealed rotating electro-hydraulic connector, hydraulic lines and an electrical link and includes a pump for the fluid having the lower density, a tank for collecting at least part of the fluid expelled from the sample and a programmed micro-computer for acquiring signals from a means for measuring and controlling transfer of the fluids, to maintain the interface between the two fluids at a constant level during operation.

15. (New) A device as claimed in claim 9, wherein the rotatable connector includes sealed hydraulic channels including a first channel for connection to a hydraulic system and a tank for collecting at least part of the fluid expelled from the sample and connected to the at least one vessel by a second channel of the rotatable connector.

16. (New) A device as claimed in claim 10, wherein the rotatable connector includes sealed hydraulic channels including a first channel for connection to a hydraulic system and a tank for collecting at least part of the fluid expelled from the sample and connected to the at least one vessel by a second channel of the rotatable connector.

17. (New) A device as claimed in claim 11, wherein the rotatable connector includes sealed hydraulic channels including a first channel for connection to a hydraulic system and a tank for collecting at least part of the fluid expelled from the sample and connected to the at least one vessel by a second channel of the rotatable connector.

18. (New) A device as claimed in claim 12, wherein the rotatable connector includes sealed hydraulic channels including a first channel for connection to a hydraulic system and a tank for collecting at least part of the fluid expelled from the sample and connected to the at least one vessel by a second channel of the rotatable connector.

19. (New) A device as claimed in claim 13, wherein the rotatable connector includes sealed hydraulic channels including a first channel for connection to a hydraulic system and a tank for collecting at least part of the fluid expelled from the sample and connected to the at least one vessel by a second channel of the rotatable connector.

20. (New) A device as claimed in claim 9, comprising a rotating electro-hydraulic connector provided with at least one sealed hydraulic channel connected to the hydraulic system and a tank for collecting at least part of the fluid expelled from the sample which is secured to mobile equipment.

21. (New) A device as claimed in claim 10, comprising a rotating electro-hydraulic connector provided with at least one sealed hydraulic channel connected to the hydraulic system and a tank for collecting at least part of the fluid expelled from the sample which is secured to mobile equipment.

22. (New) A device as claimed in claim 11, comprising a rotating electro-hydraulic connector provided with at least one sealed hydraulic channel connected to the hydraulic system and a tank for collecting at least part of the fluid expelled from the sample which is secured to mobile equipment.

23. (New) A device as claimed in claim 12, comprising a rotating electro-hydraulic connector provided with at least one sealed hydraulic channel connected to the hydraulic system and a tank for collecting at least part of the fluid expelled from the sample which is secured to mobile equipment.

24. (New) A device as claimed in claim 9, wherein the rotatable connector is a rotating electro-hydraulic connector with sealed hydraulic channels communicating the hydraulic system, the at least one vessel is arranged symmetrically relative to the rotatable mobile equipment and is driven in rotation by the means for driving.

25. (New) A device as claimed in claim 10, wherein the rotatable connector is a rotating electro-hydraulic connector with sealed hydraulic channels communicating the hydraulic system, the at least one vessel is arranged symmetrically relative to the rotatable mobile equipment and is driven in rotation by the means for driving.

26. (New) A device as claimed in claim 11, wherein the rotatable connector is a rotating electro-hydraulic connector with sealed hydraulic channels communicating the hydraulic system, the at least one vessel is arranged symmetrically relative to the rotatable mobile equipment and is driven in rotation by the means for driving.

27. (New) A device as claimed in claim 12, wherein the rotatable connector is a rotating electro-hydraulic connector with sealed hydraulic channels communicating the hydraulic system, the at least one vessel is arranged symmetrically relative to the rotatable mobile equipment and is driven in rotation by the means for driving.

28. (New) A device as claimed in claim 13, wherein the rotatable connector is a rotating electro-hydraulic connector with sealed hydraulic channels communicating the hydraulic system, the at least one vessel is arranged symmetrically relative to the rotatable mobile equipment and is driven in rotation by the means for driving.

29. (New) A device as claimed in claim 14, wherein the rotatable connector is a rotating electro-hydraulic connector with sealed hydraulic channels communicating the hydraulic system, the at least one vessel is arranged symmetrically relative to the rotatable mobile equipment and is driven in rotation by the means for driving.

30. (New) A device as claimed in claim 9, comprising a measuring and control system for controlling at least one fluid transfer to maintain the interface between the fluids at a determined level in the at least one vessel including means for determining physical parameters of the sample by accounting for amounts of the fluids displaced during operation.

31. (New) A device as claimed in claim 10, comprising a measuring and control system for controlling at least one fluid transfer to maintain the interface between the fluids at a determined level in the at least one vessel including means for determining physical parameters of the sample by accounting for amounts of the fluids displaced during operation.

32. (New) A device as claimed in claim 11, comprising a measuring and control system for controlling at least one fluid transfer to maintain the interface between the fluids at a determined level in the at least one vessel including means

for determining physical parameters of the sample by accounting for amounts of the fluids displaced during operation.

33. (New) A device as claimed in claim 12, comprising a measuring and control system for controlling at least one fluid transfer to maintain the interface between the fluids at a determined level in the at least one vessel including means for determining physical parameters of the sample by accounting for amounts of the fluids displaced during operation.

34. (New) A device as claimed in claim 9, including means for determining physical parameters of the sample by accounting for amounts of the fluids displaced during operation.

35. (New) A device as claimed in claim 10, including means for determining physical parameters of the sample by accounting for amounts of the fluids displaced during operation.

36. (New) A device as claimed in claim 11, including means for determining physical parameters of the sample by accounting for amounts of the fluids displaced during operation.

37. (New) A device as claimed in claim 12, including means for determining physical parameters of the sample by accounting for amounts of the fluids displaced during operation.

38. (New) A device as claimed in claim 13, including means for determining physical parameters of the sample by accounting for amounts of the fluids displaced during operation.

39. (New) A device as claimed in claim 14, including means for determining physical parameters of the sample by accounting for amounts of the fluids displaced during operation.

Amendments to the Drawings:

Fig. 2 and the specification have been amended to eliminate the use of duplicate reference numerals.

Fig. 6 has been amended to add reference numbers 6 to Fig. 6 as described at paragraph [0037] of the Substitute Specification.

REMARKS

The present invention is an improved device for measuring physical characteristics of a porous solid sample by performing successive drainage and imbibition phases in the presence of a first electrically conductive fluid and of a second fluid of lower density than the first fluid. An embodiment of the device includes rotatable mobile equipment including at least one elongate vessel 13 provided with an inner cavity for the samples S, the at least one vessel being fastened to an end of an end of an arm 9 secured to a fulcrum pin 10 and associated with means for balancing 12 and 14, means for driving 10 the arm in rotation for creating a centrifugal force exerted along a direction of elongation of the vessel, a system 10 and 11 for displacing at least the second fluid of lower density, and means for detecting an interface position of the fluids in the at least one vessel comprises a capacitive sonde placed in the at least one vessel along a direction of elongation thereof, for continuously detecting displacement of the interface between the two fluids in the at least one vessel, and the means for detecting an interface position of the fluids in the at least one vessel being externally connected to a measuring device through a rotatable connector.

The invention provides substantial benefits over the prior art by providing detection of a variation of the first electrically conductive fluid with good accuracy in the order of 0.02 cc. See paragraph [0025] of the Substitute Specification.

Moreover, the invention provides spontaneous imbibition of a sample which has been drained during a previous centrifugation phase and therefore allows

detection with precision the opposite displacement of the interface between the two fluids during the next decrease phase until it is equal to zero. The characteristics are very stable notably in relation to rotating speed. The accuracy obtained by using the capacitive sonde for measuring the interface level between the two fluids is translated into equal accuracy for the measure of the saturation in the sample and it allows determination of capillary pressure in the part of the bar between the interface and the face that is closest to the fulcrum pin. Finally, the sonde occupies a limited volume which allows the size of the vessel to be reduced. See paragraph [0026] of the Substitute Specification.

The drawings stand objected to regarding the utilization of duplicate reference numerals. The specification and drawings have been amended to eliminate the aforementioned objectionable usage of identical reference numerals to identify different parts and to add reference numeral 6 to Fig. 6.

Claims 5-7 stand objected to as being improperly multiple dependent claims. The claims have been rewritten to overcome the stated grounds of objection.

Claim 2 stands rejected under 35 U.S.C. §112 as being indefinite. Newly submitted claim 10, which corresponds to claim 2, has been rewritten to overcome the stated ground of rejection.

Claims 1, 3 and 8 stand rejected under 35 USC 103 as being unpatentable over USP 5,463,894 (Fleury et al) in view of USP 3,693,435 (Cox et al). The Examiner reasons as follows:

> Regarding **claim** 1, Fleury discloses a device for determining properties such as porosity of a solid sample in the presence of two fluids of different densities (fluids A and B). In the case of Fleury, the two fluids are described as, for example, oil and water. Fleury provides

rotatably movable equipment including at least one elongate vessel 2, with an inner cavity for placing the sample 1. The vessel as seen in figure 1 is fastened to an arm and secured to a fulcrum pin allowing for rotational movement about an axis. On the opposite side of the figure, a vessel of the same weight is provided as balancing means for the first vessel. A motor 13 is provided which drives the arm in rotation and creates a centrifugal force as claimed. Fleury further describes as seen in column 5, a system for forcing a displacement of fluid B within the system. Fleury describes a method of using acoustic means to follow the displacements of the interface between the two fluids in the vessel rather than a capacitive sonde as is claimed.

Cox discloses a method and device for taking fluid measurements such as a water-oil ratio within a system. Columns 3-4 of Cox describe a method of using a capacitive probe to determine the amounts of water and oil which the probe is in contact with. Cox further discloses that is common to use an acoustic measurement device to conduct the same measurements and as such It would have been obvious to one of ordinary skill in the art at the time of invention to have substituted the capacitive probe of Cox in place the acoustic measurement system of Fleury to achieve similar results. As such, the apparatus would then be able to continuously follow the displacements of the two fluids within the vessel as claimed.

Regarding **claim 3,** Fleury discloses a measuring and control system 10 similar to that which is claimed.

Regarding claim 8, the control system 10 of Fleury is intended to control the fluid transfer of fluid B and to detect the displacements in the system. Fleury further states in column 5 that the pressures on either side are balanced by the control system, thus maintaining the interface at a determined level as claimed.

These grounds of rejection are traversed for the following reasons.

The Examiner correctly observes that Fleury et al utilizes a different principal to detect the interface position in the at least one elongate vessel by relying upon an acoustic detection mechanism. See, for example, column 2, lines 37-40; column 3, lines 19-23; and further, column 7, lines 6-28, of Fleury et al.

The Examiner's reliance upon Cox et al as a secondary reference to suggest the modification of Fleury et al to arrive at the claimed subject matter is based upon impermissible hindsight.

Cox et al disclose a technique for time-averaging fluid flow and fluid characteristic signals and producing the readouts of such average signals from which a monitored fluid characteristic can be ascertained quantitatively even though the fluid flow rate may vary widely during averaging signals. See column 2, lines 27-47. Cox et al pertain to a water-cut monitor and liquid flow meter located in a distribution system which is not related to the claimed capacitive sonde for detecting the interface position in the at least one elongate vessel as recited in claim 9 and the dependent claims. Cox et al is non-analogous art relative to the claimed invention.

There is no counterpart in Fleury et al of claimed means for detecting an interface position in the at least one elongate vessel being externally connected to a measuring device through a rotatable connector. Accordingly, if a capacitive sonde was substituted in Fleury et al, the foregoing subject matter would not be achieved.

It is submitted that the Examiner's reliance upon Cox et al is misplaced. A person of ordinary skill in the art would not consider Cox et al's utilization of capacitive sensing as part of a water-cut probe 12 as described at the bottom of column 3 to motivate a person of ordinary skill in the art to make the claimed substitution of utilizing a capacitive sonde placed in the vessel which contains the sample in a system as claimed which measures characterizing of a porous sample. The Examiner's rationale that Cox et al describe a method of using a capacitive

probe to determine the amounts of water and oil which the probe is in contact with does not properly characterize the intent of the water-cut probe which is stated to permit the determination of total volume net oil and water to be determined as described in column 3, lines 34, *et. seq*. Cox et al's application is non-analogous art relative to the claimed invention.

It is submitted that the only reason why a person of ordinary skill in the art would combine Cox et al with Fleury et al would be by impermissible hindsight.

In view of the foregoing amendments and remarks, it is submitted that each of the claims in the application is in condition for allowance.

To the extent necessary, Applicants petition for an extension of time under 37 C.F.R. §1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (612.36255X00) and please credit any excess fees to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

/Donald E. Stout/
Donald E. Stout
Registration No. 26,422
(703) 312-6600

DES:dlh